

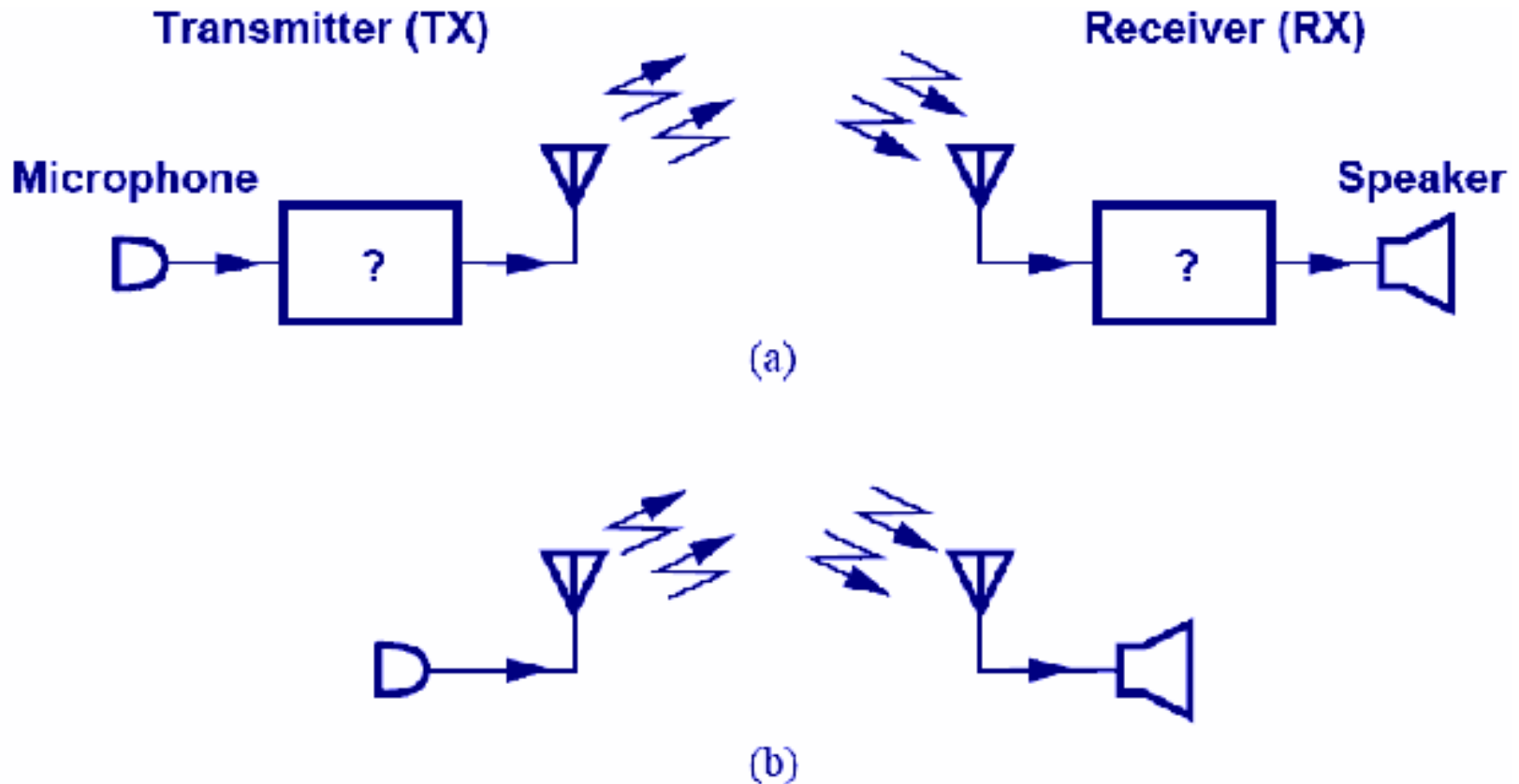
Fundamentals of Microelectronics

- **CH1 Why Microelectronics?**
- **CH2 Basic Physics of Semiconductors**
- **CH3 Diode Circuits**
- **CH4 Physics of Bipolar Transistors**
- **CH5 Bipolar Amplifiers**
- **CH6 Physics of MOS Transistors**
- **CH7 CMOS Amplifiers**
- **CH8 Operational Amplifier As A Black Box**

Chapter 1 Why Microelectronics?

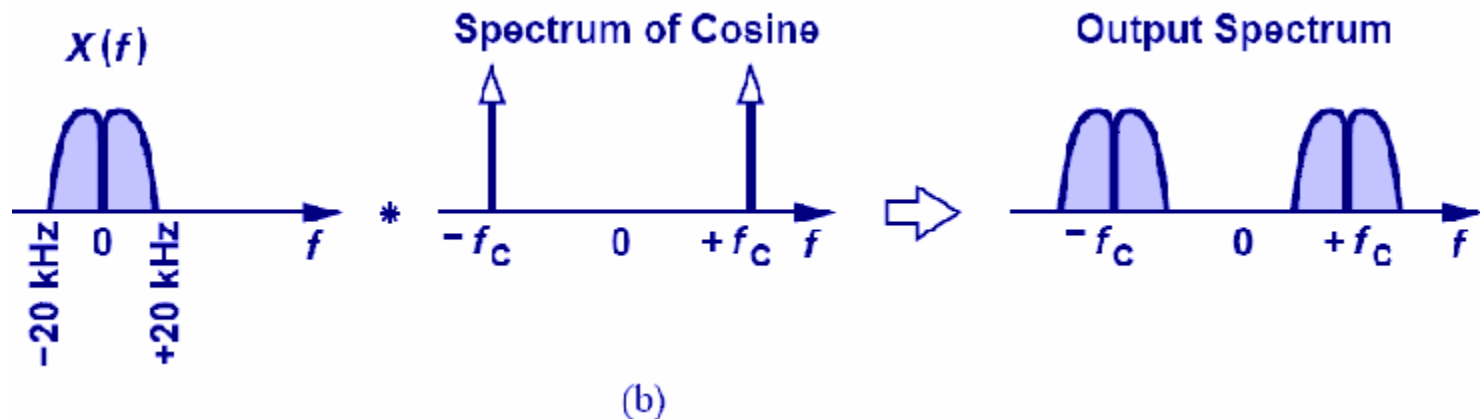
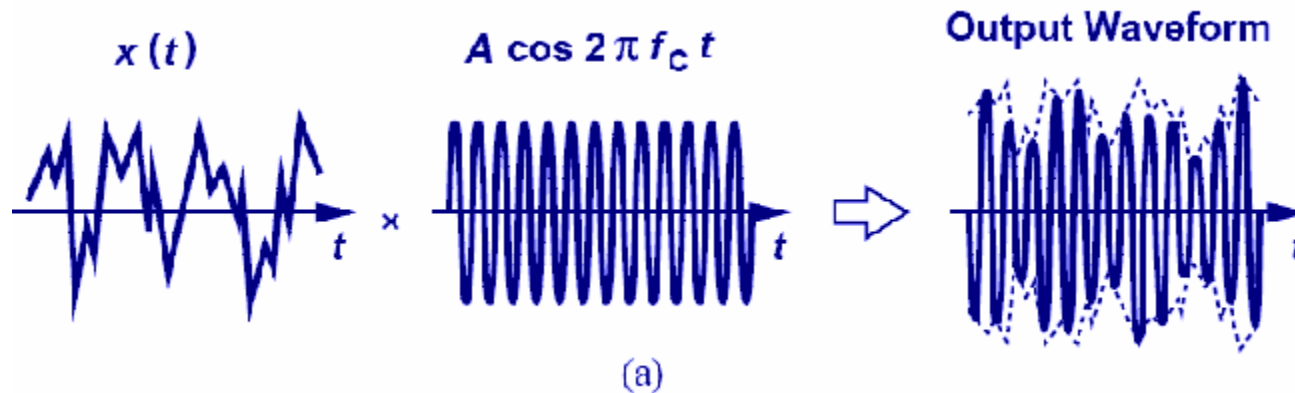
- **1.1 Electronics versus Microelectronics**
- **1.2 Example of Electronic System: Cellular Telephone**
- **1.3 Analog versus Digital**

Cellular Technology



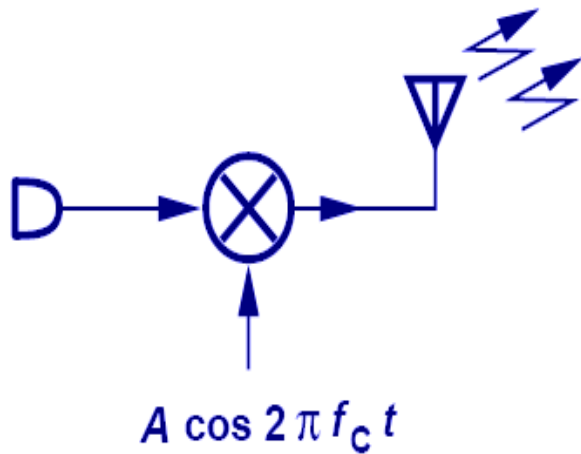
- An important example of microelectronics.
- Microelectronics exist in black boxes that process the received and transmitted voice signals.

Frequency Up-conversion

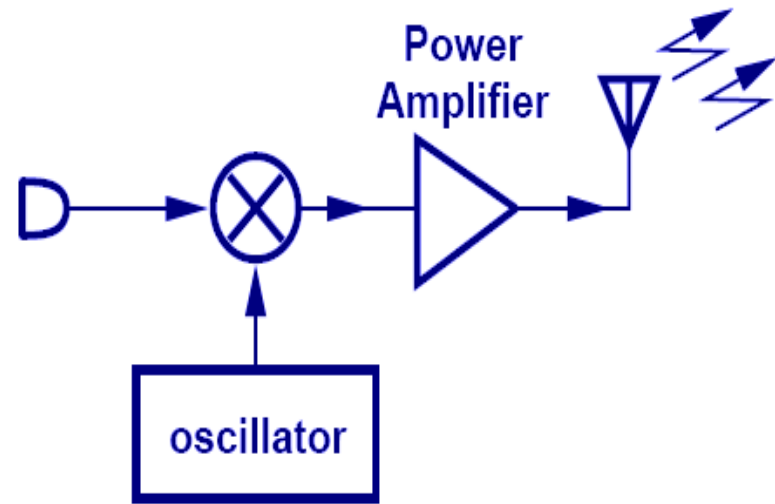


- Voice is “up-converted” by multiplying two sinusoids.
- When multiplying two sinusoids in time domain, their spectra are convolved in frequency domain.

Transmitter



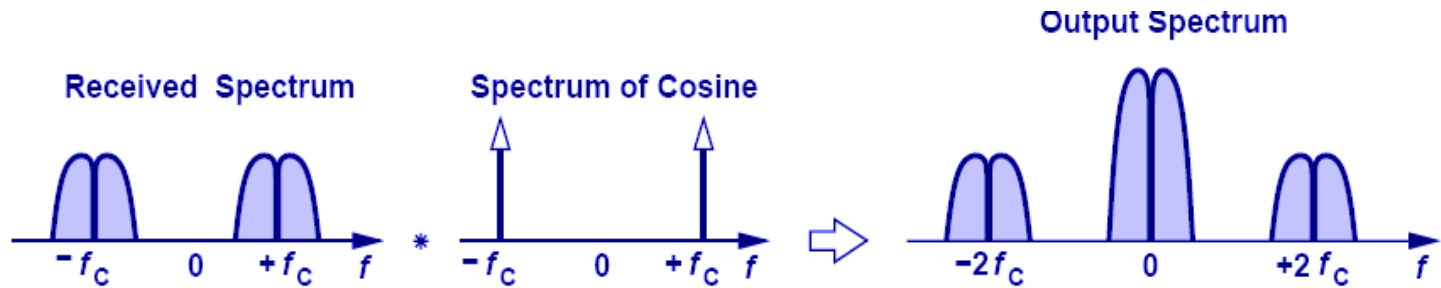
(a)



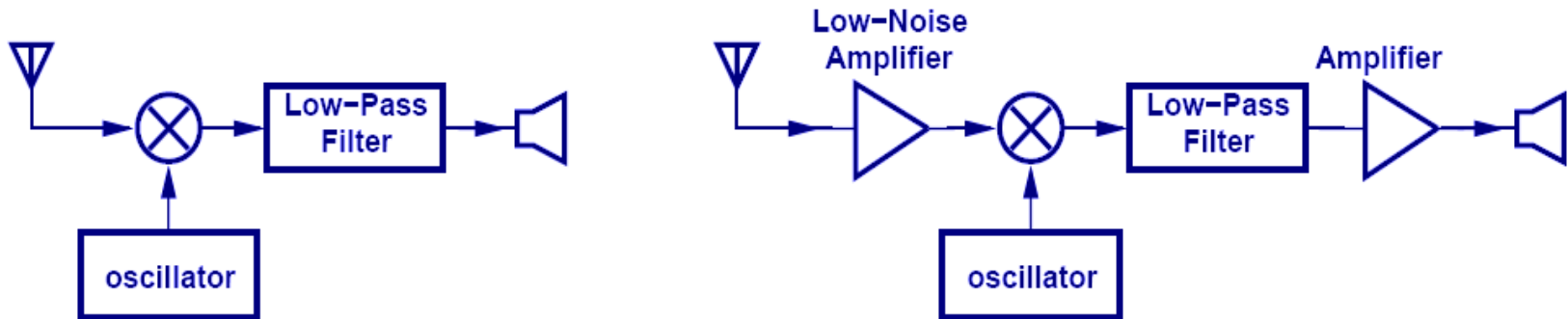
(b)

- Two frequencies are multiplied and radiated by an antenna in (a).
- A power amplifier is added in (b) to boost the signal.

Receiver



(a)

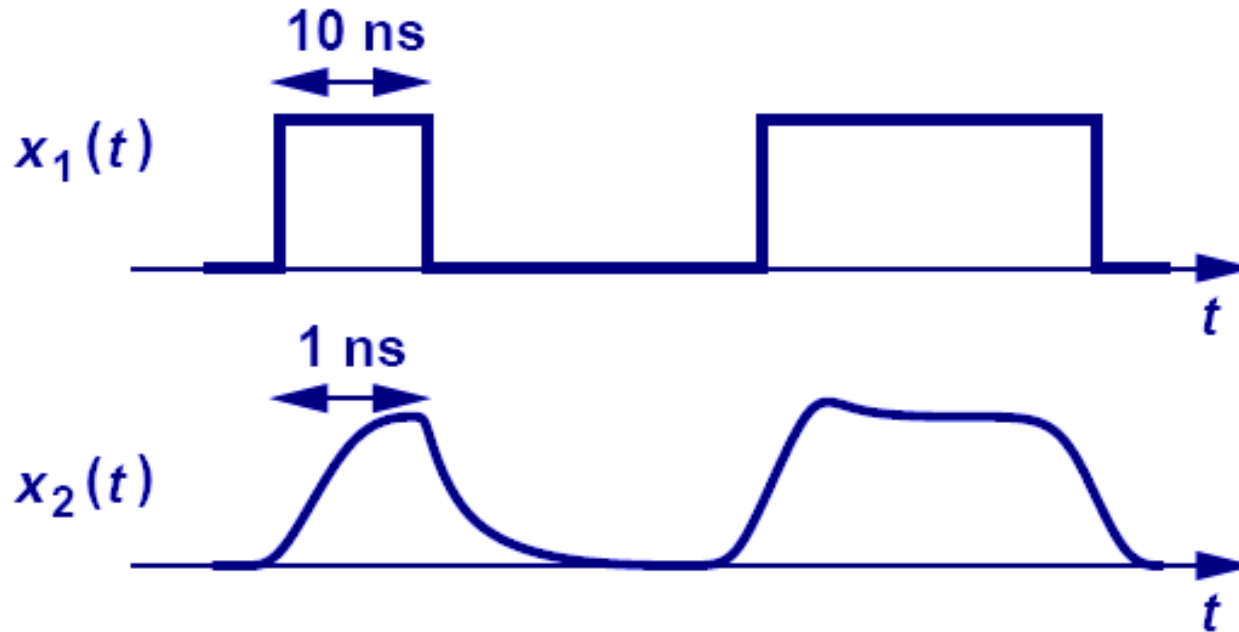


(b)

(c)

- High frequency is translated to DC by multiplying by f_c .
- A low-noise amplifier is needed for signal boosting without excessive noise.

Digital or Analog?



- $x_1(t)$ is operating at 100Mb/s and $x_2(t)$ is operating at 1Gb/s.
- A digital signal operating at very high frequency is very “analog”.